

### REMARKS

Reconsideration and further examination of the subject patent application in light of the present Amendment and Remarks is respectfully requested.

Claims 11-32 are currently pending in the application.  
Claims 11-32 stand rejected.

#### Claims Objection

Claim 14 has been objected to for certain informalities. However, claim 14 has been canceled, thereby obviating the objection.

#### Rejections Under 35 U.S.C. §112

Claims 25 and 27 have been rejected under 35 U.S.C. §112, second paragraph as being indefinite. However, claims 25 and 27 have been canceled, thereby obviating the rejection.

#### Rejections Under 35 U.S.C. §103

Claims 11-32 have been rejected under 35 U.S.C. §103(a) as being obvious over U.S. Pat. No. US 5,333,200 to Cooper et al. Applicant respectfully traverses this rejection.

In response, independent claims 11-32 have been canceled and replaced by new independent claims 33-40, respectively. The new

independent claims have been rewritten to incorporate the concept of a loudspeaker-listener layout.

FIG. 8 shows the concept of first and second loudspeaker-listener layouts that are different. The loudspeaker-listener layout on the left shows a first loudspeaker-listener layout with four speakers and the right side shows a second loudspeaker-listener layout with two speakers.

Previous versions of claims for this application, including parent U.S. 5,889,867, have been interpreted as being ambiguous by the examiner(s) in several ways.

For example, "location" was intended by the applicant to mean the position of a listener relative to some loudspeakers, but the examiner of '867 took it to mean "venue," e.g., "recording studio" versus "home listening room." In an attempt to clarify the meaning of "location," the word "space" was used. This led to the question of whether the first group of listeners had to be in a different room than the second group of listeners, introducing more confusion.

In the pending application, for example in Claim 11 (now canceled), the location of a listener and locations of a plurality of listeners were recited. The intention was that these "locations" are defined with respect to the loudspeaker "locations," but in some cases the locations of the loudspeakers in the two scenarios might differ.

Also, there was confusion and ambiguity related to whether the various pluralities of listeners had to listen all at once or could listen sequentially.

There has been confusion whether the listeners in the second

group had to be different than the listeners in the first group, and whether the second group of loudspeakers had to be different than the first group of loudspeakers. (In '867, applicant choose to narrow the scope of some of the claims by adding the word "other" in order to clarify the scope of the claims.)

The confusion was not anticipated or intended by the applicant, who believes that the present version of the claims (using a uniform style of presentation and based upon the concept of *loudspeaker-listener layouts*) is clearer and easier to understand than previous versions. The word "layout" is used 41 times in the specification and thus provides ample context for use in the claims. Layout is defined in the specification independently of venue, space, or room, and doesn't imply anything about whether some of the loudspeakers or listeners can be or must be the same; a layout simply specifies the geometrical arrangement of the various loudspeakers and listeners which comprise a listening situation. (Nonetheless, all of the claims that describe more than one listener in the second loudspeaker-listener layout, in their present form, include the phrase, "and wherein the plurality of listeners of the second loudspeaker-listener location all listen simultaneously."

When reading the claims, the reader should note that the fundamental idea of this invention is shown in Fig. 2: the first layout is on the left and the second layout is on the right. The first matrix of transfer functions is from the (vector) inputs  $\mathbf{p}_0$  to  $\mathbf{s}_0$ . The second matrix of transfer functions is from  $\mathbf{s}_0$  to  $\mathbf{e}_0$ . The third matrix of transfer functions is from  $\mathbf{s}$  to  $\mathbf{e}$ . And the fourth, derived, matrix

of transfer functions are from **p** to **s**. It might help to remember that "**p**" stands for "program," "**s**" stands for (loud) speakers, and "**e**" stands for "ears."

The modified, more unified claim language, in all independent claims, characterizes these relationships more accurately, e.g., "second matrix of transfer functions from the plurality of loudspeakers of the first loudspeaker-listener layout to the ears of the first listener of the first loudspeaker-listener layout;" certain earlier versions of some of the claims may have been less clear in describing the origination of some of the matrices and thus may have inadvertently been drawn too broadly.

The Applicant is a co-inventor of Cooper et al (Cooper and Bauck, U.S. 5,333,200) which Examiner cites against the present application. As such, applicant has intimate knowledge of '200 and first-hand insight into its contents and interpretation.

Applicant Bauck worked with Cooper for many years developing the ideas in this application and its parent, U.S. 5,889,867, as well as six other related U.S. patents. In 1992, they published a paper, "Generalized Transaural Stereo," which describes some of the ideas which underly the present invention. In late 1992 and 1993, they developed the ideas in this application and published them in a second paper, "Generalized Transaural Stereo and Applications," the "applications" being generalized layout reformatters (Jerry Bauck and Duane H. Cooper, "Generalization Transaural Stereo and Applications", Journal of the Audio Engineering Society, Volume 44, Number 9, pages 683-705, September, 1996). The original application was filed in 1996

after Cooper's passing in 1995.

At the time that Cooper and Bauck did the work that is described in the application, no one (else) had even formulated the problem of how to properly change the loudspeaker signals when a program that was intended for one layout was actually played back over another layout (where a layout is a particular arrangement of a particular number of loudspeakers and a particular number of listeners). Cooper and Bauck, after working with two-channel systems for some time, carefully formulated the problem and then developed solutions.

The Examiner asserts that "Cooper et al (hereinafter Cooper) discloses . . . the method of substantially recreating a binaural impression of a sound perceived by a first listener from an audio source for a plurality of other listeners" (Office Action of 12/16/05, page 3) and lists four figures in Cooper to support this statement. However, none of the referenced figures show more than one listener. Recall that applicant's previous response to an Office Action dated October 3, 2005 modified all independent claim language to require simultaneous multiple listeners, in order to reduce any possible confusion regarding multiple serial listeners.

The Examiner asserts that "Cooper teaches, in Figure 10b, a method for recreating the binaural impression for a single second listener in a location that is different from the location of the first listener" (Office Action of 12/16/05, page 3). This is believed to be in error, and indicates that Examiner does not fully appreciate the underlying significance of the invention, or understand the significance of Figure 10b in the earlier patent. Figure 10b clearly

shows a single listener—this is not a second listener, but a *first* listener in a *second listening space*. The first listening space, in the example provided by Figure 10b, has a single first listener in a first listening space which is characterized by having speakers at  $\pm 30^\circ$ . Figure 10b shows a reformatter playing through speakers at  $\pm 15^\circ$  in a second space to a first listener in that second space, the purpose of the reformatter to make the speakers at  $\pm 15^\circ$  sound, to the first (and only) listener in the second space, like the speakers from the first space sounded to the first (and only) listener in the first space. There are two spaces—one with speakers at  $\pm 30^\circ$  with a single, centrally located listener, and another with speakers at  $\pm 15^\circ$ .

Examiner refers to Column 24, Lines 26-31 (Office Action of 12/16/05, page 3), suggesting that Cooper anticipated the modification of the reformatter for two listeners listening simultaneously. This passage appears in the context of an extended discussion beginning at column 23, line 6, relating to circumstances where in the case of a very strong symmetry, a second listener can be accommodated, but with a reversed image. This condition was addressed in the Response of October 17, 2005 by adding and modifying other claims to deal explicitly with symmetric and asymmetric conditions, with a narrowing of claims accordingly. In the present response, claim 32 (now new claim 40) has been further narrowed to accommodate the situation described in Cooper beginning at column 23, line 6. And yes, naturally, to fully accommodate more than one listener, the reformatter of the claimed invention is different than the Cooper reformatter, and this is in fact the purpose of the current

application, which reveals those details which are not taught by Cooper.

The Examiner discusses the transfer functions S and A of Cooper (Office Action of 12/16/05, page 3). In brief, Examiner asserts that it is obvious how to extend Cooper, Figure 10b, to accommodate more than one listener ("each second listener"). In the Examiner's opinion, the reformatter of 10b could be duplicated for each additional listener, but with modifying transfer functions S and A according to where each additional listener is seated. As clearly stated in the Response of October 17, 2005, this will not work, and thus is the reason that the applicant submitted the instant patent application. The reason that the Examiner's design won't work is that there are crosstalk paths which will not be canceled with the Examiner's design. The following is a paraphrased quote from the Response of October 17, 2005, beginning on the lower third of page 18 and continuing to the top of page 20:

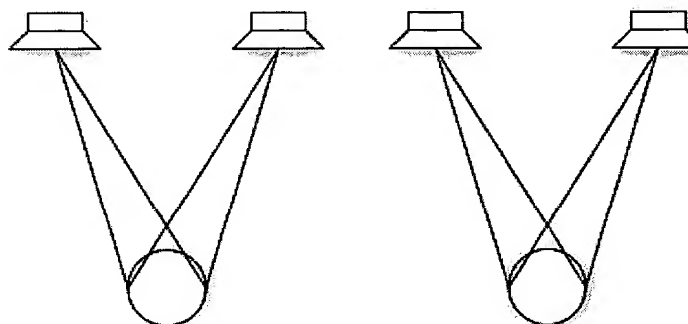
If the several listeners in the second space of the Examiner's scenario are present simultaneously, then Examiner's proposed solution to her scenario will fail. She proposes setting up a Cooper-style two-speaker reformatter for each listener present in the second space. This, she supposes, can be accomplished by each listener, in effect, getting his or her own location-specific A and S transfer functions. The failure comes because there are more crosstalk paths than are supposed in Examiner's solution.

Let us postulate, for the sake of making a concrete example, that there are four speakers and four ears. The Examiner seems to propose dividing the speakers into two pairs, matching up one to one with the obvious pairs of ears on the listeners. Then, she proposes treating the problem as two separate Cooper-style crosstalk cancelation problems. This will fail because the proposed solution does not take into account the *additional crosstalk paths* between

"unpaired" speakers and ears. Specifically, listener 1 will get crosstalk from listener 2's speakers. In matrix terms, Examiner's proposed crosstalk cancelation matrix, will have all 0's in the upper right 2x2 submatrix and in the lower left 2x2 submatrix. The *correct* crosstalk canceler, the one taught in the application, has all 16 elements of the 4x4 matrix filled in with non-zero terms.

It is believed that the full-blown, 4x4 solution is non-obvious in the face of decades of people trying to figure out how to do proper audio recording and playback.

To assist in visualizing Examiner's proposed solution applied to the 4 x 4 example, consider the following figure. (Note that no specific geometry is implied by the figure even though a rather regular layout is shown);

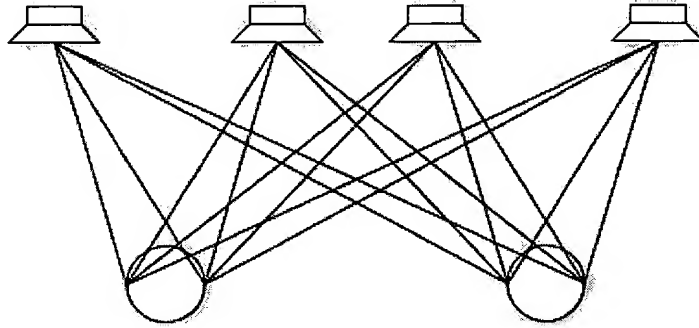


The mathematical matrix of transfer functions for this situation would be filled as shown below, with "X" generically marking non-zero transfer functions:

X	X	0	0
X	X	0	0
0	0	X	X
0	0	X	X



However, this conception does not model the actual situation because it does not consider all of the ways that sound can travel from each speaker to each ear. The figure below shows the actual situation.



Note that there are 16 sound paths, not eight, and that the matrix of transfer functions has the form shown below.

$$\begin{vmatrix} \mathbf{x} & \mathbf{x} & \mathbf{x} & \mathbf{x} \\ \mathbf{x} & \mathbf{x} & \mathbf{x} & \mathbf{x} \\ \mathbf{x} & \mathbf{x} & \mathbf{x} & \mathbf{x} \\ \mathbf{x} & \mathbf{x} & \mathbf{x} & \mathbf{x} \end{vmatrix}$$

If the additional acoustic paths are not accounted for in the matrix and in subsequent calculations based on the matrix, then a poor recreation of various perceptions (c.f. the claims) will be realized.

The Examiner refers to claims 14, 17 (now new claims 34 and 35), and 18, asserting that they are similar to Claim 13 (now canceled). However, Claim 13 was a two-line dependent claim, depending upon claim 11 (now new claim 33). Claims 14 (new claim 34) and 17 (new claim 35) are each, independent claims with no similarity to Claim 11 (new claim 33). Claim 18 is dependent upon Claim 17 (new claim 35) and has no similarity to Claim 11 (new claim 33).

Examiner's comments seem to apply to Claim 14 (new claim 34). Claim 14 (new claim 34) describes a situation in which the first space has a particular speaker layout and a single listener, and the second space has the same speaker layout but a plurality of listeners. Furthermore, Figure 10b is limited to only two speakers, whereas Claim 14 (new claim 34) teaches (along with the details of the specification) how to make a reformatter for more than two speakers. Applicant maintains that that teaching is novel and not obviously derivable from Cooper or any other prior art.

Claim 14 (new claim 34) specifically calls for more than one listener in the second layout, a situation not taught by the Cooper references. The reference to Cooper teaches using only two speakers in the second layout; Claim 14 (new claim 34) differs in that the second layout is the same as the first layout; thus, Cooper does not anticipate Claim 14 (new claim 34), since Examiner's reference to Cooper specifically calls for the speaker angle in the second layout to be  $15^{\circ}$  where the speaker angle in the first layout is  $30^{\circ}$ , clearly indicating that the two layouts are different. Also, applicant draws Examiner's attention to the revised Claim 14 (new claim 34) using the more unified language.

The Examiner asserts that "Cooper shows the method of recreating an acoustic perception of a listener in a first space (space with loudspeakers at  $\pm 30^{\circ}$ ) for a listener in a second space (space with loudspeakers at  $\pm 15^{\circ}$ ) in Fig 15" (Office Action of 12/16/05, page 4). However, Fig. 15 is unrelated to having speakers at such angles and does not refer to recreating such perception.

The matrix of transfer functions of Cooper FIG. 8b do not represent transfer functions from loudspeakers to ears as required by the second matrix of Claim 20 (new claim 36); column 18, line 65 does not describe transfer functions from program inputs to loudspeakers as required of the first matrix of Claim 20 (new claim 36); Examiner does not show how the third matrix of the claim reads on Cooper; so that any fourth matrix of the claim also does not read on Cooper.

Claim 20 (new claim 36) specifies that the second layout has more than four loudspeakers; Cooper does not teach that.

Examiner's problematic figure reference notwithstanding, it may be assumed that the context of the Examiner's complaint is about the reformatter in the case of  $\pm 30^\circ$  and  $\pm 50^\circ$ . Cooper does not teach how to make a general reformatter or a reformatter when there are more than four loudspeakers in the second space. Examiner's reference to Column 24, Line 26, in which the Examiner claims that Cooper teaches how to make a reformatter with four loudspeakers in the second space (and by obvious extension according to Examiner, to more than four), is inappropriate. As stated earlier, this reference is in the context of and at the end of a lengthy exposition in Cooper about a very special layout in which there is a two-fold symmetry requirement; Cooper does not teach the general case with more than four speakers, only the specific case with symmetry.

Page 5 of the Office Action of 12/16/05 exemplifies problems with the use of the word "location." Here and in other places in this Office Action, Examiner appears to be using the word "location" in multiple ways. Examiner seems to use "location" to refer to the

placement of phantom images. At other times, Examiner uses "location" to refer to the placement a listener with respect to a particular speaker arrangement. For example, Examiner uses the phrase, "to recreate sources at a location (the example provided by Cooper is  $\pm 50^\circ$ ) other than the location of the speakers for the first listener" (Office Action of 12/16/05, page 5). In no place in the application is the word "location" used to mean either the placement of a phantom image or a venue. The only use of "location" in the application that does not refer to the placement of a person is once, as a way of specifying a particular matrix element. "Location" appears only three times in the specification except for the matrix reference.

Applicant requests that Examiner consider the amended Claim 20 (new claim 36) written in the "unified" language of loudspeaker-listener layouts.

The Examiner asserts with regard to claim 22 (now canceled) that "Cooper shows the product of two matrices (comparing Fig. 10b with Fig. 10a)" (Office Action of 12/16/05, page 5). However, Examiner doesn't distinguish between Cooper 10b, which shows the *combining* of two matrices into a single matrix, with Claim 22 (now canceled), which clearly describes the *factoring* of a single matrix into a product of two matrices.

The Examiner asserts with regard to claim 23 (now canceled) that "Cooper shows the sum or difference of two matrices (col. 22, lines 3-56)" (Office Action of 12/16/05, page 5). This is still another inappropriate reference. These lines do not describe the sum or difference of two matrices. This was explained in detail in the

October 3, 2005 response to the second Office Action. In short, this passage never shows a matrix sum or difference; all of the summed and differenced objects are simple scalar quantities.

With regard to claim 25 (now claim 37) and claim 27 (now claim 38) and claims 28-30 (now canceled), the Examiner appears to have failed to grasp the meaning of the Response of 10/17/05. The relevant parts of the Response of 10/17/05 are repeated for the benefit of the Examiner.

With regard to claim 25, it is believed that . . . , Examiner means Fig. 18 which shows the second-space layout with three evenly-spaced speakers and two listeners placed symmetrically with respect to the speakers, with one listener getting an undesired, reversed image. The undesirability may result from, for example, a symphonic music lover hearing the symphony displayed backwards--symphony orchestras have a traditional arrangement with various instruments and instrument sections always in the same relative place on the stage. Claims 25 and 27 are clearly drawn to "recreating acoustic perception(s)"; a reversed image is not a recreation. The function of Fig. 18 is made clear in Cooper et al., column 23, lines 13 and 14: "The design is for the second head 684 to hear reverse stereo, namely  $L'=R$  and  $R'=L$ ."

Examiner states, "Cooper... fails to show there is more than one listener in a first space." Claims 25 and 27 both require more than one listener in the first space, so the relevance of the remark is not clear.

Examiner states, "[Cooper's method of recreating applies] ...for more than one listener in a second space..." (Office Action of 6/2/95, page 4) but by the discussion about Fig. 18 above, this is not true.

Examiner then discusses a scenario (Office Action of 6/2/05, pages 4-5) in which several speaker orientations in the first space could have a reformatter designed for each orientation, thus offering a plurality of acoustic perceptions. A listener in the second space ("user") could then select which of the speaker orientations from the first space that is to be recreated. However claim 25 is now limited to the context requiring that the one or more acoustic perceptions be recreated simultaneously.

The Examiner's argument appears to be based on the listeners of the second space (layout) being able to select one of the perceptions of the first space (layout). Claim 25 (new claim 37) and Claim 27 (new claim 38) say nothing of selecting a perception.

With regard to claim 31 (new claim 39), the Examiner states that "The claimed limitation that the plurality of listeners in both first and second space will be discussed in more detail" (Office Action of 12/16/05, page 7). However, the limitation of a plurality of listeners in the first space is not present in claim 31 or new claim 39. In addition, defining A and S transfer functions for each listener of the second layout will fail to provide a recreation because of the unaccounted-for transmission paths, as discussed above in connection with the two figures. Reconsideration of new claim 39 is respectfully requested.

New claim 40 has been amended herein to claim exactly three loudspeakers in the second layout and now describes a very specific definition of symmetry which is directed to the symmetric three-loudspeaker scenarios of Cooper.

As to Figure 14 of Cooper, the listener is in fact located symmetrically with respect to the loudspeakers, as described in the amended Claim 32 (now claim 40). The fact of symmetry is supported by the specification, for example, Column 6, Line 43, "FIG. 14 is a generalized block diagram illustrating a specific embodiment of a

reformatter for a symmetric three-loudspeaker layout according to the invention," and Column 21, Line 7, "The two systems 600, 610 of FIGS. 12 and 13 may be taken in superposition to form the three-loudspeaker symmetric arrangement 620 shown in FIG. 14." Other specification support for symmetry can be found in the discussion in and around Column 21 as loudspeaker angles and calculations are mentioned.

In general, Cooper does not teach the simultaneous recreation of an acoustic perception to a plurality of listeners in a second loudspeaker-listener layout or the recreation of an acoustic perception of a first listener in a first loudspeaker-listener layout to a second listener in a second loudspeaker-listener layout wherein the first and second loudspeaker-listener layouts are different. As such, Cooper does not teach or suggest each and every claim limitation. Since Cooper does not teach or suggest each and every claim limitation, the rejections are improper and should be withdrawn.

#### Closing Remarks

For the foregoing reasons, applicant submits that the subject application is in condition for allowance and earnestly solicits an early Notice of Allowance. Should the Primary Examiner be of the opinion that a telephone conference would expedite prosecution of the subject application, the Primary Examiner is respectfully requested to call the undersigned at the below-listed number.

The Commissioner is hereby authorized to charge any

additional fee which may be required for this application under 37 C.F.R. §§ 1.16-1.18, including but not limited to the issue fee, or credit any overpayment, to Deposit Account No. 23-0920. Should no proper amount be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 23-0920. A duplicate copy of this sheet(s) is enclosed.

Respectfully submitted,  
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June 16, 2006  
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